Kreikenbaum

Ash Analysis of Foods

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THE ASH ANALYSIS OF FOODS

BY ADOLPH KREIKENBAUM

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Adolph Kreikenbaum under Dr. Grindley

ENTITLED The ash analysis of Foods

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

OF B.S. in Chemistry

Arthur W. Palmer.

HEAD OF DEPARTMENT OF Chemistry.

The Ash Analysis of Foods.

One of the most common questions of the day is that of Pure Foods. It agitates state legislatures and busies the chemists. The wholesale adulteration of foods has led to strict laws, which are designed to protect the consumer from the deceit of unscrupulous manufacturers.

Chemical analyses are generally necessary to enforce these laws, for, without them it is difficult to distinguish the genuine from the adulterated article. Yet even there the chemical analyses often fail, because the manufactured substance may give results close to those of the genuine. The most conspicuous example of this class is maple syrup. The amount of sugar

before and after inversion is the determination usually made. Now an article may be manufactured which can contain just about the required amount of sugars as found by the polariscope in the genuine article and composed of dextro rotatory or laevo rotatory as the case may be. Then also the essential ether which was isolated within the last ten years is added to give it the much valued flavor and the "maple syrup" is ready for the market.

The various condiments are most frequently adulterated by worthless additions and the unsuspecting consumer robbed of his money and sometimes of his health. Vinegar is another substance commonly adulterated.

In these and in others the organic analyses have often failed to indicate whether the substances were genuine or not. An article in the Journal of the American Chemical Society entitled, "Cider Vinegar: Its Solids and Ash," by R. E. Doolittle and W. H. Hess drew my attention to a possible indicator for a new method. These men had determined the mineral constituents of samples of pure cider vinegar, apple pomace and spurious vinegars. In these instances some of the mineral constituents of the spurious substances varied considerably from the amount in the pure cider vinegar.

Again a report in the Bulletin of the Connect

-icut Experiment Station showed that out of sixty one samples of maple syrup obtained in twenty two cities, seven only deviated from the average result, while the rest were so nearly alike that the genuine could not be distinguished from the adulterated, though there is reason to believe that the article is much adulterated. In perusing the journals I was unable to find any literature upon ash analysis outside of the one mentioned above and I, therefore, resolved to test its value. This I did by using a genuine cider vinegar and a white wine vinegar, a genuine maple syrup known to be such and

one obtained from a city grocery and labled "maple syrup"; then a sample of ground pepper and cinnamon. The latter I compared with unground samples of pepper and cinnamon. The unground samples were obtained from a wholesale house in Chicago and were samples from different countries. Samples from different countries were taken as it was thought that the difference of the ground in different countries would vary the mineral constituent.

The method of analysis used was that described in Bulletin 46, U. S. Department of Agriculture, Division of Chemistry for ash analysis.

	White Wine Vinegar 1.	Cider Vinegar 2.	Canned Maple Syrup 4.	Genuine Maple Syrup 5.	Unground Pepper 6.	Tellichery Pepper 8.	Singapore Pepper 9.	Unground Cinnamon 7.	Saigon Cinnamon 10.	Batavia Cinnamon 11.	Canton Cassia Cinnamon 12.
SiO_2	1.93	0.73	1.49	4.08	12.11	2.12	7.39	8.96	1.70	0.65	2.33
Mn_3O_4	0.35	0.12	0.06	0.10	0.42	—	0.06	0.14	0.11	0.26	0.28
CaO	24.94	2.05	9.69	4.32	18.15	6.29	6.66	14.67	32.57	34.81	20.73
MgO	6.24	2.31	5.16	2.77	4.38	2.79	2.17	2.80	1.73	2.33	4.68
SO_3	16.34	6.85	8.53	1.95	1.79	4.18	4.14	2.94	4.16	3.53	6.92
Fe_2O_3	1.44	—	0.46	0.09	2.76	0.66	1.17	3.56	0.38	0.51	0.05
Al_2O_3	2.44	—	3.36	7.17	12.66	9.18	14.19	10.39	7.28	6.01	12.26
P_2O_5	2.75	26.23	9.51	0.30	2.10	30.94	9.40	1.99	2.59	3.42	4.16
Cl	2.28	8.62	18.00	1.69	1.79	7.47	4.15	Trace	0.74	0.21	Trace
K_2O	23.36	29.61	8.29	31.18	12.11	11.27	30.68	9.30	25.95	29.29	42.32
Na_2O	10.97	23.55	35.62	31.88	7.60	24.66	14.81	5.79	18.12	16.17	5.24
Sand				12.17	21.69	0.79	3.49	37.15	1.53	0.72	2.55

By glancing over the tabulated results of the analyses, comparisons can easily be made. Vinegar 1 is white wine vinegar and vinegar 2 pure cider vinegar. These results bear out the work of Doolittle and Hess. The high per cent of lime in vinegar 1 would indicate the use of that substance in its manufacture. As might be expected the amount of phosphoric acid is much greater in the cider vinegar than in the white wine vinegar.

Syrup 4 is a canned article obtained from a city grocery and labled maple syrup, while syrup 5 is a sample of maple syrup known to be genuine. There are no very marked differences here. Contrary to expectations syrup 4 has a much higher per cent of

phosphoric acid. The chlorine also is considerably higher in syrup 4, while the potash of syrup 5 is much higher. As only one sample of the genuine maple syrup was analysed no definite statement can be made.

Even if results were reasonably close in a number of samples of the pure syrup, the method would be too unpractical for use, for too much time is consumed obtaining the ash, as the foaming of the mass necessitates much watching and the burning down of the charred mass is a tedious operation.

Pepper 6 is a sample of ground pepper obtained from a grocery, pepper 8 unground Tellichery and pepper 9 unground Singapore. Most of the constituents of the ground pepper vary con-

siderably from the amount in the unground. The only constituents reasonably close are Al_2O_3 and K_2O. The K_2O of the ground pepper and of the Tellichery agree closely, but that of the Singapore is far from them. The amounts of phosphoric acid in all three are wide apart. The lime, magnesia and sulphuric acid of the Tellichery and Singapore peppers are very close, while that of the unground is quite different. Here it would seem that a possible indicator may be found in the lime, magnesia and sulphuric acid, and a little more work might be done to test the matter further. There is not the objection to the method here as with the syrup, for the pepper is readily burned to ash and needs no watching.

A glance at the cinnamon columns shows plainly that the results vary too much to be of any use as indicators. The three unground samples of cinnamon, i.e., which are Saigon, Batavia and Ceylon Cassia respectively, do not agree. They agree some places in pairs, but the third again is far off. The ground cinnamon, however shows results far different from the others but that is due to the large amount of sand which was plainly used as an adulterant being present in the ash to the amount of thirty seven per cent as compared to one to two per cent in the unground.

Judging from the work here done and from the results obtained it would seem that the ash analyses

could not be used as an indicator between genuine and adulterated foods, as the ash content in samples of the genuine varies considerably, so that no definite amount can be set down as an indicator for the pure stuff. The only place where the method seems to work is in the case of the vinegar, where the results obtained bear out the work of Doolittle and Hess. The most that can be said of the investigation is that it shows negative results.

"Approved"
H. S. Grindley,
Associate Professor of Chemistry,
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